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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/593,444

02/05/2007

Makiko Kitazoe

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ARENT FOX LLP
1050 CONNECTICUT AVENUE, N.W.
SUITE 400
WASHINGTON, DC 20036

EXAMINER

MILLER, JR, JOSEPH ALBERT

ART UNIT

PAPER NUMBER

1792

NOTIFICATION DATE

DELIVERY MODE

02/03/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No. 10/593,444	Applicant(s) KITAZOE ET AL.	
	Examiner JOSEPH MILLER JR	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 January 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19 is/are pending in the application.
- 4a) Of the above claim(s) 1-7 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 01/11/2009 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claimed language requires "rectangular pulsed flows" however it is not clear how the flows can be rectangular. According to the MPEP 7.34.02, Where applicant acts as his or her own lexicographer to specifically define a term of a claim contrary to its ordinary meaning, the written description must clearly redefine the claim term and set forth the uncommon definition so as to put one reasonably skilled in the art on notice that the applicant intended to so redefine that claim term. *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1357, 52 USPQ2d 1029, 1033 (Fed. Cir. 1999).

It is examiner's position that while a "rectangular" shape may be known when referring to a pulse, it would be the shape of an electrical pulse and not to a gas flow. Furthermore, because applicant has not defined the term with adequate specificity in the application, the claim is indefinite.

For purposes of examination, the term will be considered a flow that is created by switching a valve to flow into a chamber (for example) when the flow is already started flowing to a vent/exhaust (for example). This embodiment of the term is explained in instant specification but the term is not specifically limited.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 8-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamoto (2002/0104477) in view of Wang (2004/0121085), Nguyen (6,689,220) as evidenced by Raaijmakers (2002/0052124).

Yamoto teaches the formation of a silicon nitride film using silane, ammonia, and hydrogen gases flowed to a substrate, after being activated by a catalyst [0148]. Yamoto teaches a hydrogen gas treatment step after film formation (the silane and ammonia are turned off and it is clear that the hydrogen is still flowing), the purpose of

the hydrogen flow is to purge the other reactants [0149] but the selection of hydrogen is linked to performance of the catalyst body [0021].

Yamato does not (explicitly) teach the formation of a multi-cycle film for the formation of a multi-layer film of a single type (i.e. a multi-layered SiN film) wherein the second treatment is not a subsequent deposition step.

Wang teaches a method of forming a silicon nitride film (abstract). Wang teaches the deposition of silicon nitride using chlorine-containing gases and ammonia [0025-0026]. Wang teaches that the films may be treated with a nitrogen source gas after deposition [0028] followed by exposure to hydrogen radicals (including the use of hydrogen gas) after the nitrogen exposure step [0033], the hydrogen radicals being formed by a hot wire process and used when a chlorinated and/or organo silicon precursor is used [0030]. Wang teaches that the hydrogen radicals can penetrate less than 100 angstroms deep into the film [0035] and therefore if a thicker film is required, multiple layers should be deposited in order to achieve a desired thickness.

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the post-SiN film formation treatments of Wang (nitrogen followed by hydrogen) to the hot wire SiN film formation technique of Yamato because the nitrogen step would increase the N/Si ratio and reduce hydrogen [0028] and the hydrogen treatment step would remove chlorine from the film [0029-0032].

The nitrogen then hydrogen treatment steps of Wang would follow the hydrogen purge of Yamato. Because the hydrogen purge of Yamato includes maintaining the temperature of the catalyst, the hydrogen would be available as an active species.

It would be obvious to repeat the steps, as taught by Wang, so that a complete SiN could be formed with effective removal of the chlorine. Wang teaches that a 200Å thick silicon nitride film is useful for 65 nm technology [0037].

Yamamoto in view of Wang teaches all aspects of the instant claims except the step of providing and a step of opening a first valve and closing a second valve.

Nguyen teaches a method of depositing a highly controlled layered film (abstract). Nguyen teaches the use of a system and method including the use of a gas supply line which includes an additional line and valve to go to vent and a second line and valve to go to the process chamber (col 7, lines 13-21; Fig. 3). Nguyen further teaches flowing gas into the vent prior to flowing to the chamber (i.e. opening the valve to the vent, closing that to the vessel and then switching the valves).

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the pulsation method of Nguyen involving flowing gas to vent to the method of Yamamoto in view of Raaijmakers and Mase as it would allow for a pulsation technique without requiring stabilization time (col 7, lines 18-22). While Nguyen does not explicitly teach the inclusion of an MFC, the prior art references teach control of flow rate: Yamamoto [0074, for example] and Wang [0026] teach the control of a flow rate (in sccm, versus pressure, for example) - Raaijmakers provides evidence that the use of MFCs to control the flow rate of gases is known [0051].

Examiner holds that the teaching of Nguyen sufficiently discloses a “rectangular pulsed flow” as required in instant claims.

Regarding claims 8 and 9, it would be obvious to repeat the treatment steps to effect a usable film. The repetition of treatments and anneals is well known in the deposition art. In instant case, because the hydrogen treatment step would potentially leave more hydrogen than is desired in the film, it would be obvious to re-treat with a nitrogen treatment.

Regarding claim 10, Wang teaches continuous formation of the film including treatment steps for a number of layers [0037].

Regarding claim 11, Yamoto teaches the discharge of the gases from the process chamber [00149] taught by Yamoto is a vacuum pump [0065].

Regarding claim 12, the nitrogen step adds nitrogen to the film and the hydrogen step depletes chlorine (or carbon) from the film.

Regarding claim 13, Wang teaches that the hydrogen treatment may include nitrogen gas and therefore the final step includes a film component.

Regarding claim 14, Wang teaches the use of ammonia instead of hydrogen (i.e. reading on 'rare gas' required in claim) and nitrogen, helium or argon.

Regarding claim 15, Yamoto teaches deposition using silane and ammonia. Wang teaches the use of hexachlorodisilane (HCD) as a silane source gas [0025]. It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of HCD instead of silane as a viable alternative and to allow for improved step coverage of the resulting film [Wang, 0024].

Regarding claim 16, Wang teaches the use of ammonia (hydride of nitrogen) as a surface treatment gas.

Regarding claim 17, all limitations are taught as per Yamoto in view of Wang as described above regarding claims 8 and 14.

Regarding claim 18, the process as taught by Wang is with an ammonia treatment after the nitrogen treatment.

Regarding claim 19, the teaching of Nguyen is generic to gas flow control and examiner takes the position that the control method taught to avoid a stabilization time period would be obvious to apply to any and all of the gases in a pulsed process.

Response to Arguments

Applicant's arguments with respect to instant claims have been considered but are moot in view of the new ground(s) of rejection.

Applicants have amended previous claims to require a flow of gases to vent prior to flowing to chamber; arguments over the prior art previously applied are limited to arguments over the prior art not teaching that limitation of the instant claims. Examiner has provided the teaching of Nguyen and the rationale for modification of the film formation process that makes such steps obvious.

The rejection over Yamamoto in view of Mase has been withdrawn because it is examiner's position that the rejection over Wang more succinctly teaches claimed matter.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOSEPH MILLER JR whose telephone number is (571) 270-5825. The examiner can normally be reached Mon - Thurs, 7am to 6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/JOSEPH MILLER JR/
Examiner, Art Unit 1792

/Timothy H Meeks/
Supervisory Patent Examiner, Art Unit 1792